Environmental Health Sciences Department
College of Public Health
University of Georgia

EHSC 4090
Bioremediation
Spring, 2008 Syllabus

Course Information

Instructor:	Dr. Anne Marie Zimeri
Office Location:	EHS 203
Phone:	706-542-9567
Email:	zimeri@uga.edu
Office Hours:	T-F 3:30-4:30, or by appointment

Course Meeting Time and Location

Building: EHS
Room: 101
Days: MWF
Time: 2:30-3:20

Textbooks and Other Course Material

We will be working from the primary literature throughout the semester so that student will have the most up to date information in the field of bioremediation.

We will be using WebCT throughout the semester. The syllabus, lecture outlines, literature pdfs, and assignments, will be posted on the WebCT course page.

Course Description

Bioremediation is the treatment of contaminated soils, sediments, and groundwater by microorganisms, fungi, plants or components from these organisms. Course will overview organism physiology, genetic engineering, and details of environmental health hazards amenable to bioremediation. Course will explore case studies that exemplify approaches to bioremediation (phytoremediation, bioreactors, composting, rhizofiltration, etc.)

Course Learning Objectives

This course will give students an understanding of the biological mechanisms involved in pollutant uptake, accumulation and transformation in organisms currently used in the field. Students will gain knowledge of the full suite of contaminants present at Superfund and industrial sites and the potential for these to be remediated using the techniques we will discuss in class. We will be specifically analyzing the use of bacteria, fungi, and plants (and their associated microbes) to remediate environmental pollution. Students will learn to differentiate which technologies may be used in which cases, and why. Throughout the course, we will be using current literature in the field; students will learn to evaluate data from these manuscripts and will learn presentation skills appropriate for use in scientific seminars. In addition, students will synthesize what they have learned by designing a bioremediation plan for a given site including control contingencies for transgenic organisms and wildlife and human safety. Finally, students will learn to reference the State and Federal laws, regulations and guidelines applicable to biologic agents.

Course Requirements for Grading Purposes

Grades will be based on two exams and student presentations.

*In addition to exams and presentations, graduate students will be assigned a special topic for further investigation. Topics must be reported in a 2-3 page paper as well as shared with the class in a 20 minute presentation. This assignment will be weighted as 20% of the student's semester grade.

Grading Policy

There will be two 50-minute exams given throughout the semester. **THERE WILL BE NO MAKEUP EXAMS**. Exams will primarily cover the material discussed since the prior exam, though you may be tested on basic concepts on any exam. Questions related to exam grades must be made within one week of the return of the graded exam.

Grading: *Grades will be based on the following points:

Exam 1	100 points
Exam 2	100 points
Exam 3	100 points
Presentation 1	100 points
Presentation 2	100 points

Letter Grades: A 90-100%
B 80-89%
C 70-79%
D 60-69%
F < 59%

Grading policy (cont'd)

Presentations: Students will be given one article and asked to select one article for class presentations. Each student selected article must be submitted one week in advance so that it may be made available to the other student on WebCT. The student will present, explain and evaluate the data included in the paper prior to leading a class discussion.

* graduate students will have a total of 600 points (100 points from their special topic report and presentation). Each student will critically review one current technical journal article on an approved special topic that is of particular interest to the student. This includes both a written and oral discussion. The day of your oral presentation, you will submit a 4 page literature review of the topic, and a 3 page summary and written critique of the article. Cite a minimum of 4 other related journal articles, discussing agreement, disagreement, or extension of the work. The student will present the article during class and help lead a class discussion.

Make-Up Policy

NO MAKE UP EXAMS will be administered. If you have a valid, documented excuse for missing an exam, you may receive and 'Incomplete' for the semester and finish the course the next time it is offered.

Attendance Policy

Attendance is mandatory.

University Honor Code and Academic Honesty Policy

All academic work must meet the standards contained in "A Culture of Honesty." All students are responsible to inform themselves about those standards before performing any academic work. http://www.uga.edu/ovpi/academic_honesty/culture_honesty.htm.

Students with Disabilities

Students with disabilities who require reasonable accommodations in order to participate in course activities or meet course requirements should contact the instructor or designate during regular office hours or by appointment.

General Disclaimers

The course syllabus is a general plan for the course; deviations announced to the class by the instructor may be necessary.

PLEASE TURN OF ALL CELL PHONES AND PAGERS DURING CLASS

Date	Student Presenters	Lecture Topic/ Paper
01/07	Zimeri	Class Introduction & Lecture 1: Overview
01/09	Zimeri	Lecture 2: Bioremediation
01/11	Zimeri	Lecture 3: Bioreactors
01/14	Zimeri	Lecture 4: Conclusions
01/16	Zimeri	Genetic Engineering: Wofenbarger 2000; Singh 2006
01/18	Zimeri	1. Engineered phytoremediation of ionic- and methyl-mercury: Genetic mechanisms of resistance, accumulation, and volatilization Rugh et al, 1996**;** Heaton et al., 1998; Rugh et al., 1998**;** Meagher et al., 2000b (review); Heaton et al., 2003; Che et al., 2003;
01/21		NO CLASS (MLK Holiday)
01/23	Zimeri	1. continued
01/25	Zimeri	2. Mercury Continued (Methylmercury is a more serious contaminant than ionic mercury) Dhankher et al., 2002**;** Gong et al., 2003**;** Lee et al., 2003a**;** Dhankher et al., 2006
01/28	Zimeri	2. continued
01/30	Zimeri	3. Engineered and native plant processing of TNT (trinitrotoluene) and other toxic compounds derived from munitions Best et al., 1997; French et al., 1999; Hannink et al., 2001; Van Aken et al., 2004; Meagher, 2001 (N&V)
02/01	Zimeri	3. continued
02/04	TBD	3. continued
02/06	Zimeri	**EXAM 1**
02/08	Zimeri	4. Natural plant hyperaccumulators of cadmium, nickel, and zinc: Preliminary data on the genetic basis for tolerance and sequestration of these toxic metals by plants Kramer et al., 2000**;** Persans et al., 2001**;**
02/11	TBD	4. continued: Kerkeb and Kramer, 2003;
02/13	Zimeri	**5.** Engineered and native plant processing of TCE (trichloroethylene) a dominant global pollutant Gordon et al., 1998**;**
02/15	TBD	**5.** continued : Doty et al., 2000**;** Doty et al., 2003;

02/18	Zimeri	6. Potential phytoremediation of nitrogen dioxide air pollution Morikawa and Erkin, 2003; Morikowa et al., 1998; Morikawa et al., 2003; Takahashi et al., 2001; Goshima et al., 1999;
02/20	TBD	6. continued: Takahashi et al., 2005
02/22	TBD	7. Peroxidase and nitrate processing Sakamoto et al., 2004; Sakamoto et al, 2003;
02/25	Zimeri	8. More issues of biosafety, biotechnology and the environment: Lessons from natural herbicide resistant weeds. Gene flow. Baucom & Mauricio, 2004**;** Lu & Snow, 2005; Snow, 2003b**;** Jorgensen et al, 1999**;**
02/27	TBD	8. continued: Snow, 2002**;** Snow et al., 2005
02/29	TBD	8. continued: Ellstrand, 2003**;** Ellstrand, 2001
03/03	Zimeri	9. Remedial Biomicrobes. Engineering of improved microbes and enzymes for bioremediation. Chen et al.,1999
03/05	Zimeri	9. Microbial community structure and trichloroethylene degradation in groundwater. Humphries et al., 2005
03/07	TBD	Student Selected Papers
03/10-03/14		**SPRING BREAK**
03/17		9**.** Microbial production and application of sophorolipids : Van Bogaert et al., 2007
03/19		9. Role of soil rhizobacteria in phytoremediation of heavy metal contaminated soils. J Zhejiang et al 2007
03/21		**Review**
03/24		**EXAM 2**
03/26	Zimeri	10. Composting/ Biopiles Bioremediation of petroleum hydrocarbon-contaminated soil by composting in biopiles. Joergenson te al., 2000
03/28	TBD	10. A field trial for an ex-situ bioremediation of a drilling mud-polluted site. Rjas-Avelizapa 2007
03/31	Zimeri	10**.** The application of bioassays as indicators of petroleum-contaminated soil remediation. Plaza et al., 2005. Biostimulation and bioaugmentation for on-site treatment of weathered diesel fuel in Arctic soil. Thomason-Lacroix 2002
04/02	Zimeri	11**.** Chemical Transformations. Monitoring of microbial metal transformations in the environment. Wiatrowski et al., 2005

04/04	Zimeri	11. Bioremediation of soils contaminated with explosives. Lewis et al., 2004
04/07	Zimeri	Exploring the biochemical properties and remediation applications of the unusual explosive-degrading P450 system XplA/B. Jackson et al., 2007
04/09	TBD	Student Selected Papers
04/11	TBD	Student Selected Papers
04/14	TBD	Student Selected Papers
04/16	TBD	Student Selected Papers
04/18	TBD	Student Selected Papers
04/21	TBD	Student Selected Papers
04/23	Zimeri	State and Federal Legislation: Biosafety CDC/NIH guidelines, Regulations of transgenics
04/25	Zimeri	State and Federal Legislation: community concerns, disposal, RCRA, EPCRA
04/28	Zimeri	Review
05/02		**FINAL EXAM 3:30-6:30**